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# Prevalence and risk factors for asthma and chronic bronchitis in the capitals Helsinki, Stockholm, and Tallinn

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**Abstract** The aim of this part of the FinEsS-studies was to assess whether differences existed in prevalence of asthma, chronic bronchitis, and respiratory symptoms between three Baltic capitals, and to examine risk factor profiles for respiratory conditions. In 1996, a postal survey was performed in these cities with a response rate of 72% in Stockholm, 76% in Helsinki, and 68% in Tallinn. The prevalence of physician-diagnosed asthma was 7.6% in Stockholm, 6.2% in Helsinki, and 2.3% in Tallinn, while respiratory symptoms were most common in Tallinn. The prevalence of physician-diagnosed chronic bronchitis was 10.6% in Tallinn, 3.4% in Helsinki, and 3.0% in Stockholm. Risk factor analyses revealed a significantly increased risk for those living in Tallinn compared to that of Stockholm for wheezing conditions, OR 1.56–1.69, longstanding cough, OR 1.92 (1.74–2.13), attacks of shortness of breath during the previous 12 months, OR 1.35 (1.20–1.52), and chronic productive cough, OR 1.49 (1.28–1.74). Subjects having symptoms common in asthma were more likely to have physician-diagnosed asthma in Stockholm and Helsinki than in Tallinn, while subjects having bronchitis symptoms had more often physician-diagnosed chronic bronchitis in Tallinn. Prevalence of respiratory symptoms was higher in Tallinn than in Stockholm and Helsinki, while physician-diagnosed asthma was more common in Stockholm and Helsinki. The prevalence of physician-diagnosed chronic bronchitis was three times as high in Tallinn as in Helsinki or Stockholm. Our results also suggest large differences in diagnostic practices between the three countries, while the differences between the capitals in true prevalence of disease may be small. 

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**Keywords** asthma; chronic bronchitis; epidemiology.

## INTRODUCTION

Asthma and type-1 allergy in children are reported to be more prevalent in Western than in Eastern Europe (1–10). Type-1 allergy is also more common in Western urban areas than in rural environments (7,8,11). Furthermore, both higher (1,4) and lower (7) prevalence rates for bronchial hyperresponsiveness among children have been reported in Western than in Eastern Europe.

Respiratory symptoms, bronchial hyperresponsiveness, and atopic sensitization among adults have been reported to be more prevalent in the former West Germany than in the former East Germany (12,13). In the European Community Respiratory Health Survey (ECRHS), the prevalence of asthma was 2.1% in Erfurt in the former East Germany, and 4.4% in Hamburg (14). Comparisons between Tartu, Estonia, and Uppsala, Sweden, showed respiratory symptoms to be more common in Tartu, with prevalence of asthma attacks, hay fever, and type-1 allergy more common in Uppsala (15,16).

These studies indicate the prevalence of asthma in children and young adults only. Whether this difference is true also for the middle-aged and elderly remains unknown. As for chronic bronchitis and chronic obstructive pulmonary disease (COPD), these are more common in Eastern Europe than in Western Europe (17–21).

We have compared prevalence rates of respiratory symptoms and self-reported disease in three Baltic capitals, Stockholm (Sweden), Helsinki (Finland), and Tallinn

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(Estonia) to evaluate differences both in diagnostic traditions and in prevalence of respiratory symptoms, and to compare risk factor patterns for respiratory conditions in these cities. The situation in Eastern European countries changes rapidly. This study was performed in 1996, only a few years after the desolation of the former Soviet Union, before any major changes in the health-care system, lifestyle, or airborne exposure had occurred in Estonia.

## MATERIAL AND METHODS

### Study areas and population

The study is part of the FinEsS-study in progress in Finland, Estonia, and Sweden, aiming to assess prevalence rates and risk factors for airway disorders. A postal questionnaire was sent in 1996 to randomly selected individuals in the three capitals, with data analysed from subjects aged 20–64 years. Complete responses came from 5335 subjects in Stockholm (response rate 72%), 5671 in Helsinki (76%), and 7735 in Tallinn (68%), as a total of 18 741 (Table 1).

### Questionnaire

The questionnaires were identical, and were in each country's native languages. The questions were translated from English to Swedish, Finnish, Estonian, and Russian, and then back to English. The questionnaire was developed from a widely used questionnaire in the Nordic countries (22), which was originally developed from the British Medical Research Council's questionnaire (23) and has been previously described in detail (24).

### Definitions

Asthma and chronic bronchitis were classified into two ways: Those who answered "yes" to the questions: "Have you been diagnosed as having asthma by a doctor?" or "Have you been diagnosed as having chronic bronchitis or emphysema by a doctor?" were classified as having *physician-diagnosed asthma* or *physician-diagnosed chronic bronchitis.* Those who answered "yes" to: "Have you ever had asthma?" or "Have you ever had chronic bronchitis or emphysema?" were called as *ever asthma* or *ever chronic bronchitis.*

*Any wheeze* —"Have you had wheezing or whistling in your chest at any time during the last 12 months?"

*Recurrent wheeze* — "Have you had wheezing, whistling, or a noisy sound in your chest when breathing?"

*Wheezing with shortness of breath apart from colds* — "yes" to the question about any wheeze, and "yes" to the two questions: "Have you been at all breathless when the wheezing noise was present?" and "Have you had this wheezing or whistling when you did not have a cold?" These were first used in the IUATLD questionnaire (25).

*Current asthma* — physician-diagnosed asthma, *and* use of asthma medication, or attacks of shortness of breath during the previous 12 months, or wheezing.

*Chronic productive cough* — sputum production on most days during periods of at least 3 months in two successive years.

### Analyses

The chi-square test was used for uni- and bi-variate comparisons and one way ANOVA for testing for trends. Mantel–Haenszel test was used to calculate prevalence rates standardized by age and smoking according to the data of Helsinki. Multiple logistic regression analysis was performed in order to estimate effects of different independent variables on bronchitis and asthma symptoms. As independent variables in logistic regression instead of asthma we have used the combination of symptoms from IUATLD (25): wheezing with shortness of breath apart from colds during the previous 12 months, which also has been used in ECRHS (14). Instead of chronic bronchitis, we have used chronic productive cough, which is close to the CIBA definition for chronic bronchitis (26). Statistical analyses were performed by use of the Statistical Package for the Social Sciences (SPSS) at the National Institute for Working Life in Sweden.

## RESULTS

### Participation rates and smoking

The participation rate was highest in Helsinki, 69% for men, and 82% for women. It was, overall, higher among women than men, with the highest participation occurring in subjects of both sexes, aged 50 or older (Table 1).

Smoking habits by gender and area are presented in Table 1 and Fig. 1. Current smoking and smoking more than 14 cigarettes daily were most common in Tallinn for men of all ages. The prevalence of current smokers among men aged 20–49 was more than 60% in Tallinn. In women over 40, current smoking was most common in Stockholm, while younger women most often were current smokers in Tallinn. In contrast to Helsinki and Tallinn, current smoking was more common among women than men under 50 in Stockholm. The prevalence of current smokers was overall lowest among subjects 60–64. Differences in smoking habits were significant when comparing Tallinn to Stockholm or Helsinki, ($P < 0.001$), while Stockholm data did not differ significantly from that of Helsinki's.

**Table I.** Study population by age and gender

| | 20–29 years | | 30–39 years | | 40–49 years | | 50–59 years | | 60–64 years | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Women | Men | Women | Men | Women | Men | Women | Men | Women | Men | Women | Men |
| Stockholm | | | | | | | | | | | | |
| Study sample | 953 | 884 | 1,033 | 1101 | 814 | 838 | 693 | 661 | 239 | 237 | 3,732 | 3721 |
| Participants | 732 | 590 | 766 | 711 | 620 | 533 | 543 | 472 | 190 | 178 | 2851 | 2484 |
| Response rate (%) | 77 | 67 | 74 | 65 | 76 | 64 | 78 | 71 | 79 | 75 | 76 | 67 |
| Smokers (%) | 34 | 32 | 32 | 29 | 36 | 35 | 33 | 37 | 23 | 24 | 33 | 32 |
| Ex-smokers (%) | 10 | 7 | 18 | 14 | 21 | 22 | 26 | 29 | 22 | 36 | 19 | 18 |
| Helsinki | | | | | | | | | | | | |
| Study sample | 920 | 827 | 1039 | 994 | 978 | 873 | 772 | 652 | 260 | 223 | 3969 | 3515 |
| Participants | 760 | 506 | 832 | 656 | 787 | 599 | 647 | 490 | 216 | 178 | 3242 | 2429 |
| Response rate (%) | 83 | 61 | 80 | 66 | 80 | 69 | 84 | 75 | 83 | 80 | 82 | 69 |
| Smokers (%) | 35 | 40 | 34 | 43 | 32 | 34 | 24 | 38 | 18 | 26 | 31 | 38 |
| Ex-smokers (%) | 8 | 9 | 12 | 13 | 19 | 26 | 19 | 31 | 15 | 35 | 14 | 21 |
| Tallinn | | | | | | | | | | | | |
| Study sample | 1,273 | 1,218 | 1,428 | 1243 | 1535 | 1269 | 1,342 | 1042 | 568 | 398 | 6,146 | 5170 |
| Participants | 901 | 767 | 948 | 695 | 1,108 | 784 | 1012 | 643 | 519 | 358 | 4488 | 3247 |
| Response rate (%) | 71 | 63 | 66 | 56 | 72 | 62 | 75 | 62 | 91 | 90 | 73 | 63 |
| Smokers (%) | 42 | 62 | 41 | 66 | 35 | 61 | 20 | 47 | 11 | 37 | 31 | 57 |
| Ex-smokers (%) | 8 | 6 | 11 | 11 | 12 | 16 | 8 | 23 | 5 | 27 | 9 | 15 |

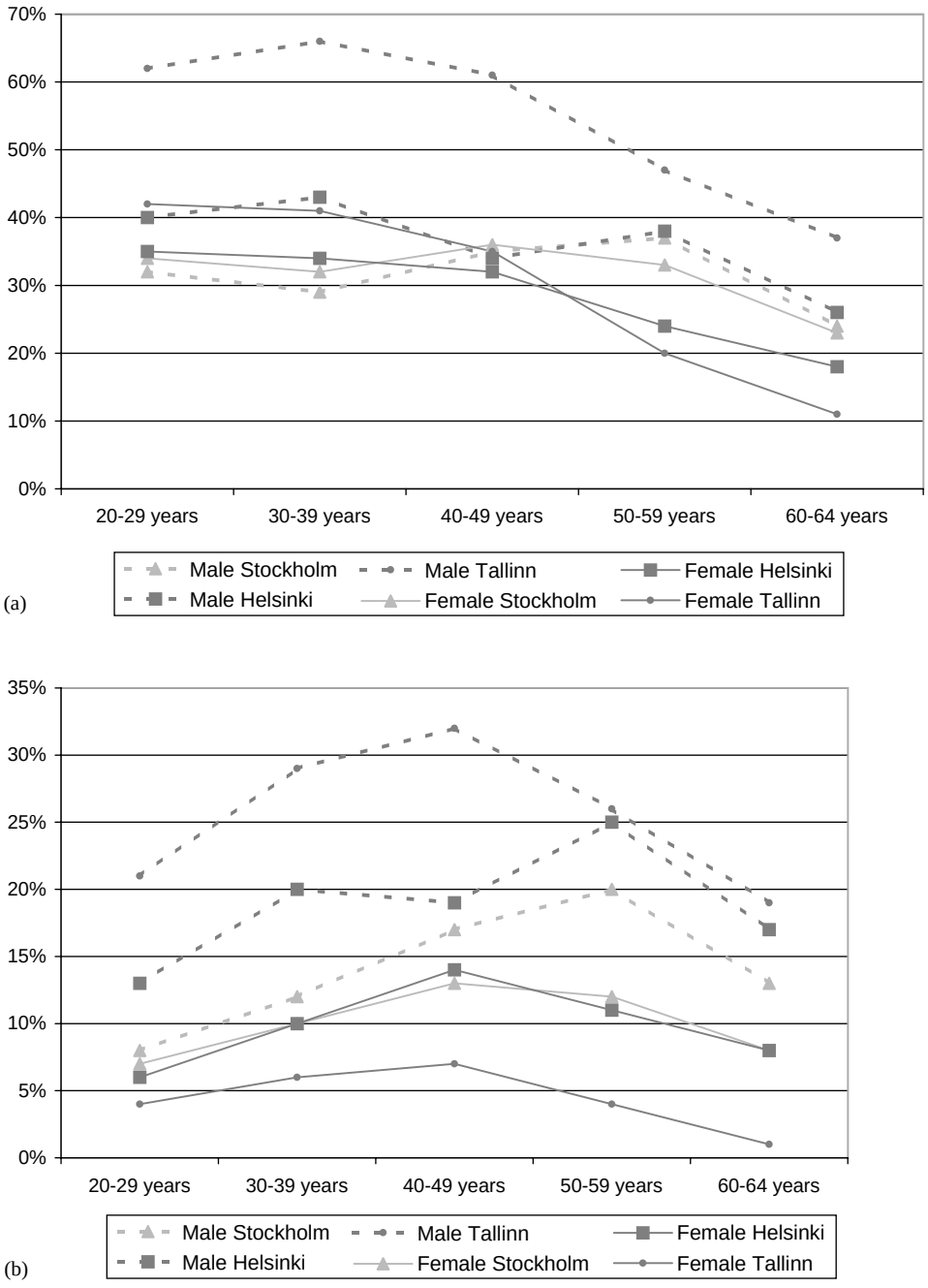


**Fig. 1.** Prevalence (%) of current smoking (a) and smoking more than 14 cigarettes daily (b) by gender in Stockholm, Helsinki, and Tallinn.

## Respiratory symptoms

Prevalence rates for respiratory symptoms by area and gender are shown in Table 2. Any wheeze during the previous 12 months and recurrent wheeze were most common in Tallinn for both genders. The prevalences of wheezing with attacks of shortness of breath apart from colds and recurrent wheeze were similar in Helsinki and in Stockholm, 6—8% in both, while any wheeze during the previous 12 months was more common in Helsinki (20%) than in Stockholm (16%). All differences in asthma-related symptoms between the areas were significant ($P < 0.001$).

Longstanding cough and sputum production were most prevalent in Tallinn, with chronic productive cough most prevalent in Helsinki. Stockholm had the lowest prevalence rates of dyspnea and bronchitis symptoms. As for asthma-related symptoms, a significant difference ($P < 0.001$) existed in prevalence rates for the bronchitis symptoms among the three cities. Stan-

**Table 2.** Prevalence rates (%) of respiratory symptoms, ever asthma, physician-diagnosed asthma, physician-diagnosed chronic bronchitis, and use of asthma medication in Stockholm (S), Helsinki (H), and Tallinn (T)

| | Men | | | Women | | | Total | | | Difference by | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S | H | T | S | H | T | S | H | T | Age | Gender | Area | Smoking |
| Attacks of SOB during previous 12 months | 9.4 | 10.7 | 13.0 | 12.0 | 14.2 | 12.9 | 10.8 (10.7) | 12.7 (12.7) | 12.9 (12.1) | <0.001 | <0.001 | <0.001 | <0.001 |
| Any wheeze | 15.1 | 21.3 | 23.1 | 16.8 | 18.9 | 20.0 | 16.0 (16.2) | 19.9 (21.0) | 21.3 (20.1) | 0.002 | 0.036 | <0.001 | <0.001 |
| Recurrent wheeze | 7.9 | 7.8 | 14.1 | 8.6 | 6.3 | 11.3 | 8.3 (8.5) | 7.0 (7.1) | 12.5 (11.3) | <0.001 | 0.003 | <0.001 | <0.001 |
| Wheezing with SOB apart from colds | 5.7 | 7.2 | 5.0 | 6.6 | 7.5 | 3.9 | 6.2 (6.2) | 7.3 (7.5) | 4.4 (4.2) | 0.008 | 0.749 | <0.001 | <0.001 |
| Ever asthma | 8.2 | 5.6 | 2.9 | 9.1 | 7.7 | 3.0 | 8.7 (9.2) | 6.8 (6.9) | 3.0 (3.1) | 0.230 | 0.012 | <0.001 | 0.041 |
| Physician-diagnosed asthma | 6.9 | 5.1 | 2.5 | 8.2 | 7.0 | 2.1 | 7.6 (7.7) | 6.2 (6.2) | 2.3 (2.3) | <0.001 | 0.017 | <0.001 | 0.536 |
| Use of asthma medication | 7.3 | 4.2 | 2.2 | 9.3 | 6.6 | 2.4 | 8.4 (8.3) | 5.6 (5.7) | 2.3 (2.3) | <0.001 | <0.001 | <0.001 | 0.537 |
| Physician-diagnosed chronic bronchitis | 2.5 | 3.6 | 9.7 | 3.4 | 3.2 | 11.3 | 3.0 (3.0) | 3.4 (3.4) | 10.6 (10.1) | 0.002 | 0.037 | <0.001 | 0.323 |
| Longstanding cough | 12.5 | 18.0 | 22.6 | 15.4 | 21.0 | 26.8 | 14.1 (14.6) | 19.7 (20.1) | 25.1 (24.4) | <0.001 | <0.001 | <0.001 | <0.001 |
| Sputum production | 15.6 | 25.4 | 29.2 | 15.9 | 27.0 | 29.6 | 15.8 (16.1) | 26.3 (27.2) | 29.4 (28.6) | 0.001 | 0.034 | <0.001 | <0.001 |
| Chronic productive cough | 5.4 | 12.2 | 10.2 | 5.7 | 11.4 | 8.0 | 5.6 (5.6) | 11.7 (12.1) | 8.9 (8.4) | <0.001 | 0.033 | <0.001 | <0.001 |

*Note*: SOB=shortness of breath. Differences (*P*-values) by age, gender, area, and smoking habits. Prevalence rates standardized by age and smoking in parentheses.

dardization by age and smoking changed the figures only slightly.

## Asthma and chronic bronchitis

Physician-diagnosed asthma was reported by 7.6% in Stockholm, by 6.2% in Helsinki, and by 2.3% in Tallinn (Table 2). "Current asthma" was also most prevalent in Stockholm, 6.8% vs 5.7% in Helsinki, and 2.1% in Tallinn. Furthermore, use of asthma medication was most common in Stockholm. Differences in prevalence of the asthma categories between the cities were significant ($P < 0.001$), and asthma was more common among women. A three- to fourfold higher proportion of subjects having any wheeze, recurrent wheeze, attacks of shortness of breath, or wheezing with shortness of breath apart from colds had a physician-diagnosed asthma in Helsinki and Stockholm than in Tallinn ($P < 0.001$) (Fig. 2). Among subjects with asthma symptoms, a greater proportion was diagnosed with asthma in Stockholm than in Helsinki, with a significant difference ($P < 0.01$) except for wheezing with shortness of breath apart from colds.

The prevalence of physician-diagnosed chronic bronchitis was considerably lower than the prevalence of chronic productive cough in Stockholm and Helsinki, while the opposite was found in Tallinn. Physician-diagnosed chronic bronchitis was reported by 3.0% in Stockholm, 3.4% in Helsinki, and 10.6% in Tallinn ($P < 0.001$, Table 2). These subjects with bronchitis symptoms were more often diagnosed as having chronic bronchitis in Tallinn than in Helsinki and Stockholm ($P < 0.001$) (Fig. 3). The difference between Stockholm and Helsinki was significant only for recurrent wheeze, $P < 0.05$.

## Multivariate relationships

Significant risk factors for chronic productive cough were smoking 5–14 cigarettes daily, OR 1.80; smoking 15 or more cigarettes daily, OR 3.78; having a family history of chronic bronchitis, OR 2.91; and living either in Helsinki or Tallinn *vs* Stockholm. The risk of having a chronic productive cough increased with age (Table 3). The risk factors for longstanding cough were similar to but lower than for chronic productive cough. In addition, longstanding cough was associated with female gender, OR 1.4.

Smoking as a risk factor for wheezing conditions and for attacks of shortness of breath increased with increasing number of cigarettes consumed. A family history of asthma, OR 2.17–2.77, and age 60–64, OR 1.30–2.29, were significant risk factors for wheezing conditions, or for attacks of shortness of breath, while gender had no large impact. Living in Tallinn was a significant risk factor for recurrent wheeze, any wheeze, and attacks of shortness of breath during the previous 12 months, OR 1.35–1.56 (Table 3).

The risk-factor profiles for wheezing conditions and chronic productive cough by area are presented in Table 4. Smoking more than 14 cigarettes daily was a significant risk factor for all the respiratory conditions in the three

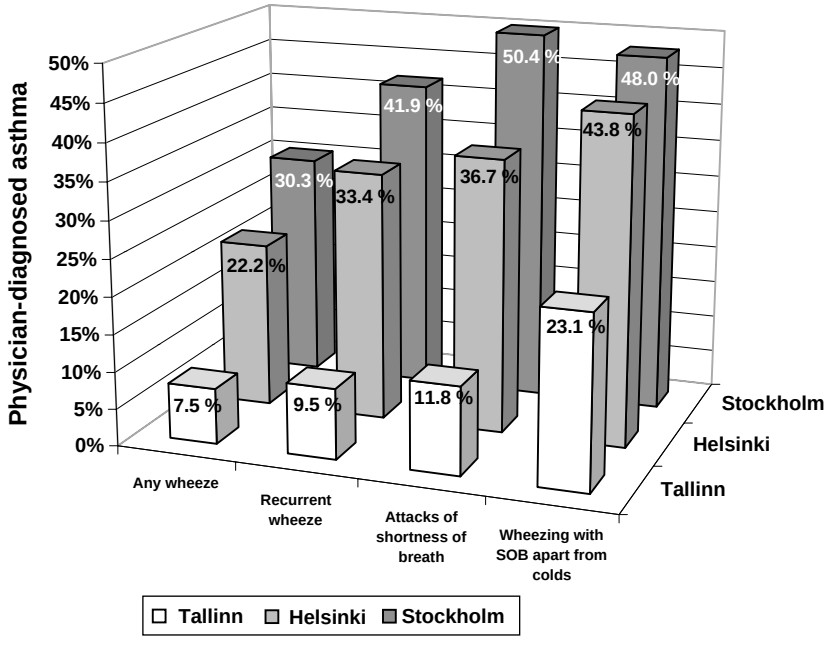


**Fig. 2.** Prevalence (%) of physician-diagnosed asthma among subjects with any wheeze, recurrent wheeze, attacks of shortness of breath (SOB) during the previous 12 months, or wheezing with attacks of shortness of breath apart from colds in Stockholm, Helsinki, and Tallinn.

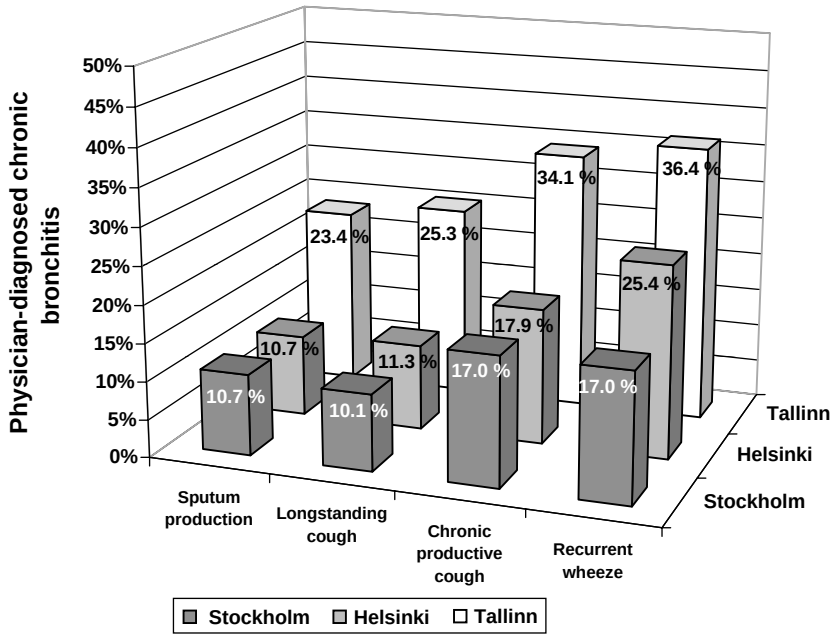


**Fig. 3.** Prevalence (%) of physician-diagnosed chronic bronchitis among subjects with sputum production, longstanding cough, chronic productive cough, or recurrent wheeze in Stockholm, Helsinki, and Tallinn.

cities, OR 2.21–5.77. A family history of asthma was a significant risk factor for the wheezing conditions, OR 2.12–3.12, regardless of the area. A family history of obstructive airway disease was a significant risk factor for chronic bronchitis, OR 1.73–2.67. Age 60–64 was a significant risk factor for all the respiratory conditions in Tallinn, and except for any wheeze, in Helsinki; while in Stockholm, age 60–64 was a significant risk factor only for recurrent wheeze (Table 4).

## DISCUSSION

The prevalence of type-I allergy has been documented to be higher in the West among both children and young adults (1,7–9,12,13,16). The majority of studies have shown asthma to be more common in the West (1–7), although many studies find no major differences in prevalence of respiratory symptoms (7,8), or find prevalence rates higher in the East (1,5,7,15). Do real differences exist in the prevalence rates for asthma in adults? Has only allergic asthma been more common in Western Europe? An increasing prevalence of hay fever and atopy in children, but not of asthma, have been shown in former East Germany after changes towards a western lifestyle (4,6). A large proportion of respiratory symptoms may be caused by nonallergic asthma in Eastern Europe, because the diagnosis of asthma has required allergic sensitization in the former Soviet Union, a practice which influenced Estonians (10). To summarize, if type-I allergy is more frequent in Western Europe, this would suggest allergic asthma to be more common in Western Europe as well. Regarding the total impact of asthma, we have to consider that the results available are somewhat divergent, and a critical review of the literature offers contradictory data.

Several factors have contributed to the validity of our results. Although conducted in 1996, the study took place in the same year and same season in all three capitals. The participation rates were all satisfactory, making the results quite representative. A nonresponder study was performed in the study centers of Northern Finland and Northern Sweden. Young men were most often nonresponders in those centers as in the centers reported in this paper. The prevalence of symptoms among nonresponders did not differ significantly from symptoms reported by those who participated originally (27).

In our study, symptoms common to asthma were in general highest in Tallinn and lowest in Stockholm, whereas the prevalence of ever asthma and physician-diagnosed asthma were highest in Stockholm and lowest in Tallinn. This raises the question whether differences in diagnostic practices may explain this discrepancy. Analyzing the proportion of those having asthma diagnosed by a physician among subjects reporting symptoms common in asthma showed that subjects with these symptoms most likely had physician-diagnosed asthma in Stockholm, while in Tallinn a considerably lower proportion of such subjects were diagnosed as having asthma. The result of the risk factor analysis was concordant with these prevalence rates. Consequently, the highest risk for recurrent wheeze, any wheeze, and attacks of

**Table 3.** Risk factors (OR) for longstanding cough, chronic productive cough, recurrent wheeze, attacks of shortness of breath (SOB) during previous 12 months, any wheeze, and wheezing with shortness of breath apart from colds during previous 12 months calculated by multiple logistic regression analysis

| Independent variables | | Dependent variables | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Longstanding cough | | Chronic productive cough | | Recurrent wheeze | | Attacks of SOB | | Any wheeze | | Wheezing with SOB apart from colds | |
| Variables | Categories | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Sex | Male | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| | Female | 1.4 | 1.29–1.52 | 1.05 | 0.94–1.18 | 1.03 | 0.93–1.15 | 1.24 | 1.13–1.37 | 1.09 | 1.01–1.18 | 1.06 | 0.93–1.21 |
| Age (year) | 20–29 | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| | 30–39 | 0.9 | 0.80–1.01 | 1.07 | 0.90–1.28 | 1.05 | 0.89–1.24 | 0.87 | 0.76–0.99 | 0.89 | 0.80–0.99 | 0.92 | 0.76–1.12 |
| | 40–49 | 1 | 0.89–1.12 | 1.36 | 1.15–1.62 | 1.37 | 1.17–1.61 | 1.04 | 0.91–1.19 | 0.89 | 0.80–1.00 | 1.09 | 0.90–1.32 |
| | 50–59 | 1.01 | 0.90–1.14 | 1.53 | 1.28–1.82 | 1.40 | 1.19–1.65 | 0.94 | 0.81–1.08 | 0.93 | 0.83–1.04 | 1.10 | 0.90–1.34 |
| | 60–64 | 1.26 | 1.09–1.46 | 2.14 | 1.75–2.62 | 2.29 | 1.90–2.77 | 1.38 | 1.17–1.63 | 1.30 | 1.13–1.49 | 1.58 | 1.25–1.99 |
| Family history of asthma | No | | | | | 1 | | 1 | | 1 | | 1 | |
| | Yes | | | | | 2.61 | 2.31–2.95 | 2.77 | 2.50–3.08 | 2.17 | 1.98–2.39 | 2.54 | 2.20–2.93 |
| Family history of chronic bronchitis or emphysema | No | 1 | | 1 | | | | | | | | | |
| | Yes | 2.84 | 2.54–3.16 | 2.91 | 2.53–3.34 | | | | | | | | |
| Smoking habits | Nonsmokers | 1 | | | | | | 1 | | 1 | | 1 | |
| | Ex-smokers | 1.05 | 0.93–1.18 | 1.18 | 0.99–1.40 | 1.23 | 1.03–1.46 | 1.27 | 1.11–1.46 | 1.25 | 1.11–1.40 | 1.41 | 1.17–1.71 |
| | Smoking < 5 cig | 1.11 | 0.96–1.29 | 1.19 | 0.95–1.50 | 1.45 | 1.17–1.79 | 1.21 | 1.02–1.44 | 1.44 | 1.25–1.66 | 1.28 | 1.00–1.65 |
| | Smoking 5–14 cig | 1.47 | | 1.80 | 1.53–2.10 | 2.59 | 2.24–2.99 | 1.42 | 1.25–1.62 | 2.28 | 2.06–2.53 | 1.53 | 1.27–1.85 |
| | Smoking < 14 cig | 2.34 | | 3.78 | 3.27–4.37 | 4.28 | 3.71–4.93 | 1.86 | 1.63–2.12 | 3.73 | 3.35–4.15 | 2.6 | 2.18–3.09 |
| City | Stockholm | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| | Helsinki | 1.51 | 1.35–1.68 | 2.38 | 2.04–2.78 | 0.81 | 0.70–0.94 | 1.23 | 1.09–1.39 | 1.35 | 1.22–1.49 | 1.22 | 1.05–1.43 |
| | Tallinn | 1.92 | 1.74–2.13 | 1.49 | 1.28–1.74 | 1.69 | 1.49–1.93 | 1.35 | 1.20–1.52 | 1.56 | 1.41–1.71 | 0.74 | 0.63–0.88 |

**Table 4.** Risk factors (OR) for chronic productive cough, recurrent wheeze, any wheeze, and wheezing with shortness of breath (SOB) apart from colds in Stockholm (S), Helsinki (H) and Tallinn (T) calculated by multiple logistic regression analysis. Nonsignificant values are in parentheses

| Independent variables | | Dependent variables | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Chronic productive cough | | | Recurrent wheeze | | | Any wheeze | | | Wheezing with SOB | | |
| Variables | Categories | S | H | T | S | H | T | S | H | T | S | H | T |
| Age | 20–29 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 60–64 | (1.38) | 2.88 | 2.21 | 2.14 | 2.31 | 2.45 | (1.04) | (0.93) | 1.79 | (1.22) | 1.68 | 2.07 |
| Gender | Male | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Female | (1.12) | (1.08) | (0.96) | (1.03) | (0.89) | (1.12) | (1.05) | (0.99) | 1.22 | (1.12) | (1.13) | (0.95) |
| Family history of asthma | No | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yes | | | | 3.12 | 2.91 | 2.15 | 2.37 | 2.12 | 2.07 | 2.70 | 2.46 | 2.45 |
| Family history of obstructive airways disease | No | 1 | 1 | 1 | | | | | | | | | |
| | Yes | 2.05 | 1.73 | 2.67 | | | | | | | | | |
| Smoking habits | Non-smokers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Smoking > 14 cigarettes/day | 2.69 | 4.64 | 3.36 | 3.15 | 5.77 | 4.43 | 2.92 | 4.58 | 4.05 | 2.21 | 3.09 | 2.50 |

shortness of breath was found for those living in Tallinn. Generally, the prevalence of asthma in Stockholm and Helsinki was close to prevalence rates found more recently in Northern Sweden (28) and in Norway (29).

Prevalence rates for chronic bronchitis and COPD have been higher in Eastern than in Western Europe (17–21). In this study, the prevalence of single bronchitis symptoms was highest in Tallinn, the prevalences of chronic productive cough were similar in Tallinn and in Helsinki, but lower in Stockholm. However, the prevalence for physician-diagnosed chronic bronchitis was approximately three times as high in Tallinn as compared to either Stockholm or Helsinki. Assessing diagnostic manners in this respect, we could notice that subjects reporting symptoms related to chronic bronchitis were most likely to have physician-diagnosed chronic bronchitis in Tallinn, while these proportions were much lower in Stockholm and Helsinki. Current smoking and heavy smoking were most prevalent in Tallinn among men, which may in part explain the high prevalence of bronchitis symptoms in Tallinn. Different diagnostic traditions have probably also contributed to the higher prevalence of chronic bronchitis in Tallinn than in Stockholm or Helsinki.

Risk factor analyses revealed that heavy smoking and having a family history of obstructive airways disease were the major risk factors for respiratory symptoms with no consistent influence of gender. An interesting finding was that the risk factor pattern was similar in the three areas, although influence of age on symptoms was most pronounced in Tallinn, whereas increasing age generally had less effect in Stockholm than in the other cities.

In conclusion, we found that most respiratory symptoms, both symptoms associated with asthma or with chronic bronchitis, were more common in Tallinn than in Stockholm or Helsinki. However, the prevalence of physician-diagnosed asthma was considerably lower in Tallinn. Subjects with symptoms common to asthma were more likely to have physician-diagnosed asthma in Stockholm and Helsinki than in Tallinn. This suggests a large difference in diagnostic practices, which to a large extent could explain the considerable differences in prevalence rates of physician-diagnosed asthma between the capitals of Sweden, Finland, and Estonia. On the other hand, subjects reporting respiratory symptoms commonly observed in chronic bronchitis were more likely to have physician-diagnosed chronic bronchitis in Tallinn than in Stockholm or Helsinki.

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## REFERENCES

1. Von Mutius E, Martinez FD, Fritzsch C, Nicolai T, Roell G, Thiemann HH. Prevalence of asthma and atopy in two areas of West and East Germany. *Am J Respir Crit Care Med* 1994; **149:** 358–364.
2. Duhme H, Weiland SK, Rudolph P, Wienke A, Kramer A, Keil U. Asthma and allergies among children in West and East Germany: a comparison between Munster and Greifswald using the ISAAC phase I protocol. *Eur Respir J* 1998; **11:** 840–847.
3. Björksten B, Dumitrascu D, Foucard T, Khetsuriani N, Khaitov R, Leja M, Lis G, Pekkanen J, Priftanji A, Riikjärv M A. Prevalence of childhood asthma, rhinitis and eczema in Scandinavia and Eastern Europe. *Eur Respir J* 1998; **12:** 432–437.
4. Weiland SK, Mutius E, Hirsch T, Duhme H, Fritzsch C, Werner B, Husing A, Stender M, Renz H, Leupold W, Keil U. Prevalence of respiratory and atopic disorders among children in the East and West of Germany five years after unification. *Eur Respir J* 1999; **14:** 862–870.
5. Von Mutius E, Fritzsch C, Weiland SK, Röll G, Magnussen H. Prevalence of atopic asthma and allergic disorders among children in united Germany: a descriptive comparison. *BMJ* 1992; **305:** 395–399.
6. Von Mutius E, Weiland SK, Fritzsch C, Duhme H, Keil U. Increasing prevalence of hay fever and atopy among children in Leipzig, East Germany. *Lancet* 1998; **351:** 862–866.
7. Bråbäck L, Breborowitz A, Dreborg S, Knutsson A, Pieklik H, Björksten B. Atopic sensitization and respiratory symptoms among Polish and Swedish school children. *Clin Exp Allergy* 1994; **24:** 826–835.
8. Bråbäck L, Breborowicz A, Julge K, Knutsson A, Riikjärv MA, Vasar M, Björksten B. Risk factors for respiratory symptoms and atopic sensitization in the Baltic area. *Arch Dis Child* 1995; **72:** 487–493.
9. Schäfer T, Vieluf D, Behrendt H, Krämer U, Ring J. Atopic eczema and other manifestations of atopy: results of a study in East and West Germany. *Allergy* 1996; **51:** 532–539.
10. Riikjärv MA, Julge K, Vasar M, Bråbäck L, Knutsson A, Björksten B. The prevalence of atopic sensitization and respiratory symptoms among Estonian schoolchildren. *Clin Exp Allergy* 1995; **25:** 1198–1204.
11. Rönmark E, Lundbäck B, Jönsson E, Platts-Mills T. Asthma, type-1 allergy and related conditions in 7- and 8-year-old children in Northern Sweden: prevalence rates and risk factor pattern. *Respir Med* 1998; **92:** 316–324.
12. Nowak D, Heinrich J, Jörres R, Wassmer G, Berger J, Beck E, Boczor S, Claussen M, Wichmann HE, Magnussen H. Prevalence of respiratory symptoms, bronchial hyperresponsiveness and atopy among adults: West and East Germany. *Eur Respir J* 1996; **9:** 2541–2552.
13. Nicolai T, Bellach B, von Mutius E, Thefeld W, Hoffmeister H. Increased prevalence of sensitization against aeroallergens in adults in West compared with East Germany. *Clin Exp Allergy* 1997; **27:** 886–892.
14. European Community Respiratory Health Survey. Variations in the prevalence of respiratory symptoms, self-reported asthma attacks, and use of asthma medication in the European Community Respiratory Health Survey (ECRHS). *Eur Respir J* 1996; **9:** 687–695.
15. Jogi R, Janson C, Björnsson E, Boman G, Björksten B. The prevalence of asthmatic respiratory symptoms among adults in Estonian and Swedish university cities. Allergy 1996; **51:** 331–336.

16. Jogi R, Janson C, Björnsson E, Boman G, Björksten B. Atopy and allergic disorders among adults in Tartu, Estonia compared with Uppsala, Sweden. *Clin Exp Allergy* 1998; **28:** 1072–1080.
17. Thom TJ. International comparisons in COPD mortality. *Am Rev Respir Dis* 1989; **140:** s27–s34.
18. Kiviloog J, Irnell L, Eklund G. The prevalence of bronchial asthma and chronic bronchitis in smokers and non-smokers in a representative Swedish population. *Scand J Respir Dis* 1974; **55:** 262–276.
19. Gulsvik A. Prevalence and manifestetions of obstructive lung disease in the city of Oslo. *Scand J Respir Dis* 1979; **60:** 286–296.
20. Lundbäck B, Stjernberg N, Nyström L, Lundbäck K, Lindström M, Rosenhall L. An interview study to estimate prevelence of asthma and chronic bronchitis — the obstructive lung disease in Northern Sweden Study. *Eur J Epidemiol* 1993; **9:** 123–133.
21. Utkin VV, Stepanov IN, Shnipas PA, Yannus LE, Gintere GB. Epidemiology of chronic bronchitis in the Baltic Republics of the USSR. *Chest* 1989; **96**(Suppl. 3): s321–s324.
22. Lundbäck B, Nyström L, Rosenhall L, Stjernberg N. Obstructive lung disease in northern Sweden: respiratory symptoms assessed in a postal survey. *Eur Respir J* 1991; **4:** 257–266.
23. Medical Research Council's Committee on the aetiology of chronic bronchitis. Standardised questionnaires on respiratory symptoms. *BMJ* 1960; **ii:** 1665.
24. Pallasaho P, Lundbäck B, Läspä SL, Jönsson E, Kotaniemi J, Sovijärvi ARA, Laitinen LA. Increasing prevalence of asthma but not of chronic bronchitis in Finland? Report from the FinEsS-Helsinki study. *Respir Med* 1999; **93:** 798–809.
25. Burney PGJ, Chinn S, Britton JR, Tattersfield AE, Papagosta AO. What symptoms predict the bronchial response to histamine? Evaluation of a community survey of the Bronchial Symptoms Questionnaire (1984) of the IUATLD. *Int J Epidemiol* 1989; **18:** 165–173.
26. CIBA Quest Symposium. Terminology, definitions, and classifications of chronic pulmonary emphysema and related conditions. *Thorax* 1959; **14:** 286–299.
27. Lindström M, Kotaniemi J, Jönsson E, Lundbäck B. Smoking, respiratory symptoms, and Diseases. A comparative study between Northern Sweden and Northern Finland: Report from the FinEsS Study. *Chest* 2001; **119:** 852–861.
28. Lundbäck B. Epidemiology of rhinitis and asthma. *Clin Exper Allergy* 1998; **28:** 3–10.
29. Svanes C, Omenaas E, Heuch JM, Irgens LM, Gulsvik A. Birth characteristics and asthma symptoms in young adults: results from a population-based cohort study in Norway. *Eur Respir J* 1998; **12:** 1366–1370.